

Observations on the biology of the Black Leaf-footed Bug *Leptoglossus australis* (F.) (Heteroptera, Coreidae) in the Territory of Papua and New Guinea

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Leptoglossus australis (F.) is closely related to the "Passion-Bug" of Queensland (*Leptoglossus bidentatus* Montr.) and it is a widely distributed common species, not only in the Territory of Papua and New Guinea but also on many smaller islands of the South Pacific Region. It also occurs in Northern Australia. As a pest of various cultivated plants, *Leptoglossus australis* (F.) has some economic importance. By New Guinea planters, orchardists, and horticulturists it is often referred to as the "Passion-Bug". However, so that *Leptoglossus australis* (F.) will not be mistaken for the near-related *L. bidentatus* Montr., the authors suggest giving the former the common name, "Black Leaf-footed Bug". The name "Leaf-footed Bug" is often used to describe coreids with flattened and expanded tibiae of the hind legs. (Wolcott, 1948.)

Leptoglossus has species in four continents. China (1930) in a table showing the geographical distribution of the genus lists one species from Polynesia, two from the "Oriental-Australian Region", one each from the Philippines, Indo-China, India, Ceylon and the Ethiopian Region, one from the Seychelles, and Mascarene, nine from the Nearctic, 28 from the Neotropical Region and one from the Chilean region.

L. membranaceus (F.), near related to *L. australis* (F.), has a very wide area of distribution. It occurs in most tropical Asian countries and in many parts of Africa. (Tillyard, 1927.) Dr. M. S. K. Ghauri (Commonwealth Institute of Entomology, London) has kindly informed the authors (in litt. 25th January, 1960) that in the collection of the British Museum there are representatives of this species from the following areas: "Southern Rhodesia, West Africa, Ghana, Mauritius, Southern Nigeria, Malayan Peninsula, Luzan, Mahe, East Africa, Gaza Land, Ceylon, India, Assam, Philippine Islands, Longo-ma-Lobah, Tenass Vall Myitta, Kavala Islands and Rodriguez Islands."

Essig (1947) records nine species of *Leptoglossus* from North America, the commonest

three being *L. zonatus* (Dallas), known under the common name of "Western Leaf-footed Bug", *L. phyllopus* (L.), recorded as a foliage pest of potato (Metcalf & Flint, 1939), and *L. oppositus* (Say). P. Lepesme (1947) records *Leptoglossus zonatus* as a pest of date palm, cedrat fruit and melon in California.

Wolcott (1948) mentions three species from Puerto Rico. These are *Leptoglossus gonagra* (F.), pest of squash, oranges, grapefruit, guava, pumpkin and corn, *L. stigma* (Herbst.), pest of guava and *Bixa orellana*, and *L. balteatus* (L.), pest of guava.

Leptoglossus australis was described by Fabricius in 1775 as *Cimex australis*. Dr. W. E. China (1930) recorded this species from Apia and Mulifauna in Samoa. He mentioned also that the species was recorded from the New Hebrides, New Caledonia, Fiji, Tahiti and Bora Bora. It is a typical fauna element of the Australian Zoo-geographical Region, which includes the Papuan Subregion.

Leptoglossus australis has a wide range of host plants in the Territory of Papua and New Guinea. Twenty-six plant species are recorded

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in this paper, representing 15 families, but severe damage is caused only to certain species of Cucurbitaceae, Myrtaceae, Passifloraceae and Rutaceae.

In appearance, *Leptoglossus australis* (F.) is most striking, being about three-quarters of an inch in length and smoky black in colour. The black colour is interrupted by a prominent orange to red band across the anterior margin of the pronotum. The underside of the body is black and spotted with the same orange to red colour. The hind legs are particularly long with the tibiae flattened and toothed, giving the insect a bizarre appearance. (See Figures I and II).

LIFE HISTORY

Breeding experiments carried out by the junior author in the entomological laboratory of Agricultural Experiment Station, Bubia (near Lae, Morobe District of New Guinea) had the following results :—



FIG. I.—Black Leaf-footed Bug [*Leptoglossus australis* (F.)] Adult. (x $2\frac{1}{2}$).



FIG. II.—Black Leaf-footed Bug [*Leptoglossus australis* (F.)] Ventral Surface. (Legs and antennae omitted.) (About x $3\frac{1}{2}$.)

The eggs were found to be pale brown coloured and measured about 1.6 mm. long and about 1.0 mm. broad. (See Fig. IIIa.) They are barrel-shaped and are usually laid in chains on the underside of the creeping stems of Cucurbitaceae and Passifloraceae. (See Fig. IIIb.) In the laboratory, females have laid up to 32 eggs in one chain but in the field the numbers laid are usually much smaller, probably because the insect is more likely to be interrupted in the process. If a suitable oviposition site is unavailable, the female will oviposit on a flat surface or even a dead twig.

In the laboratory, adults were held successfully on *Momordica Charantia* (Cucurbitaceae) cuttings in water and they readily oviposited on this plant. When laying eggs, the female first selects a suitable site and then hangs upside down from the stem and slowly moves along it, depositing each egg singly as she progresses. Each egg is affixed to the stem by a secretion from paired accessory glands which open into the distal portion of the vagina. This cement-like secretion is smeared on to the substrate before the extrusion of each egg, which is then

held in place by the tip of the abdomen, until the secretion hardens. The time taken for each egg to be laid is just under one minute.

The incubation period for the eggs is about nine days but it varies from eight to ten. The eggs in each batch generally hatch within minutes of one another. At eclosion, the nymph (neanide) pushes back the operculum of the egg and emerges headfirst. The head and thorax are first extruded, followed by antennae and legs, with the abdomen last to appear. The operculum may be pushed off completely or it may be left suspended by a flap on its rim.

L. australis passes through five stages (instars) before the adult emerges and when each instar is fully developed the insect passes to its next phase of development by shedding its skin. The length of each instar varies considerably according to food and environmental conditions but the length of the first instar is generally constant at about three days and during this period the neanide feeds very little and often not



FIG. III.—(a) Magnified egg of *Leptoglossus australis* (F.) ($\times 8$). (b) Chain of eggs of *Leptoglossus australis* (F.) (Slightly enlarged).

at all. The moulting period, like hatching, is a very critical time for the insect and sometimes it perishes because it is unable to completely free itself from the case exuvia. During moulting, the integument splits medially along the dorsal surface between the head and the thorax; the neanide then drags itself out of its exuvia and remains immobile until the new integument is fully expanded and hardened.

At each moult, the insect undergoes changes in its external appearance which are more pronounced in the later instars. In the third instar, the typical leaf-like expansions of the hind tibiae become apparent and the wing buds are visible, although they are not clearly obvious until the following instar.

The neanides are gregarious and it is often possible to see several stages and sometimes even adults on the same plant.

GEOGRAPHICAL DISTRIBUTION

Leptoglossus australis (F.) has been found in 12 of the 15 districts of the Territory of Papua and New Guinea. There are no data from the Western District, the Southern Highlands, and the Manus districts. It is most likely that the species occurs also in these three districts but very little entomological collection was carried out in these areas.

The following list of localities where *Leptoglossus australis* (F.) was taken is based on the material in the entomological collections of the Department of Agriculture, Stock and Fisheries at Port Moresby, at Highlands Agricultural Experiment Station, Aiyura, and at Agricultural Experiment Station, Bubia.

Territory of Papua

Central District: Aroa Estate, Bogura Bomana, Brown River area, Doa Plantation 14-mile Farm (near Port Moresby), Javerer Plantation, Kanosia Plantation, Lolorua Plantation, Port Moresby (Lawes Road hill, 3-mile hill and Boroko), 17-mile Farm (near Port Moresby).

Northern District: Biage (1,200-1,400 ft.), Kogona Plantation, Mamoo Plantation (1,000 ft.), Popondetta.

Gulf District: Ihu.

Milne Bay District: Esa'ala (Normanby Island), Kiriwina (Trobriands).

Territory of New Guinea

Sepik District: Bainyik Agricultural Station Tanbada Settlement (near Wewak), Wewak (gardens of the Corrective Institution).

Madang District: Amele Plantation.

Morobe District: Arou area (south side of the Markham Valley, about 500 feet above sea level), Bubia Agricultural Experiment Station Bulolo (about 2,400 ft.), Munum Village, Wai (3,000 ft.).

Western Highlands District: Korn Farm (4,700 ft.).

Eastern Highlands District: Goroka, Ovihaka Plantation, Wallis Plantation. (Altitudes 5,000-5,400 ft.).

New Britain District: Lowlands Agricultural Experiment Station, Keravat.

New Ireland District: Fatmilak Village Lagakot Plantation (Lihir Island), Lakurafang Plantation, Vuonapili Mission (Lihir Island).

Bougainville District: Kieta, Numa Numa Plantation, Wakunai Village.

In addition to the authors, the material was collected by Mrs. E. Anderson (Port Moresby) and by Messrs. J. H. Ardley (Bubia), J. H. Barrett (Aiyura), L. Byrne (Port Moresby), R. S. Carne (Keravat), W. E. Casey (Popondetta), K. S. Cole (Kundiawa), E. Cleland (Aroa Estate), G. S. Dun (Keravat), I. Edward (Keravat), L. A. Edwards (Port Moresby), W. E. Iliu (Ihu), W. V. Furniss (Port Moresby), G. Gitti (Port Moresby), E. Gray (Port Moresby), E. Green (Kanosia Estate), J. Healy (Brisbane), H. Kombega (Popondetta), A. H. Mann (Port Moresby), N. Standford (Numa Numa Plantation) and W. A. Van den Berk (Doa Estate).

The above-mentioned distribution data show that *Leptoglossus australis* (F.) is a eurythermous and eurytopus species. It occurs in the savannah and monsoon forest area, where the yearly rainfall is only 30-50 inches and in rain forest areas with up to 180 inches of rainfall. It was found at various altitudes between sea level and 5,400 feet.

Regarding the distribution of this species in areas outside the Territory of Papua and New Guinea, the authors were able to trace the following records: Guam, Marianas, Carolines (Oakley, 1953), Brit. Solomon Islands (Lever, 1948), New Caledonia (Cohic, 1951), New Hebrides (Cohic, 1953), Fiji (Lever, 1946), Western Samoa (Hopkins, 1927).

Dr. M. S. K. Ghauri (Commonwealth Institute of Entomology, London) kindly reported (in litt. 15th January, 1960) that the specimens of *Leptoglossus australis* (F.), kept in the collection of the British Museum, were collected in the following areas: "New Guinea, Solomon Islands, Queensland, New Hebrides, Kanala (North New Caledonia), Society Islands, Apia (Western Samoa), Samoan Islands, Navigator-Islands-Samoan Islands."

HOST PLANTS

As mentioned in the introduction, *Leptoglossus australis* (F.) was observed feeding on 26 plant species representing 15 families. The most important host plants are some species of the families Passifloraceae and Cucurbitaceae. On two occasions severe damage to plants of the families Myrtaceae and Rutaceae was also observed.

Very severe damage to passionfruit (*Passiflora edulis*) was recorded from the Asaro Valley (Eastern Highlands of New Guinea) in 1954. (Szent-Ivany, 1958.) Serious injury to rockmelon (*Cucumis melo*) was observed by Mr. F. X. Ryan at Ihu, in the Gulf District of Papua, where the fruits were completely covered by all instars of *Leptoglossus australis* which caused complete decomposition of the fruits. (In litt. 17th June, 1960.) Some damage to grenadilla (*Passiflora quadrangularis*) and to cucumber (*Cucumis sativa*) by this species was found by the senior author in the Northern District of Papua. Severe fruit fall of mandarins (*Citrus reticulata*) occurred in an orchard at Bulolo (Morobe District) as a result of attack by *Leptoglossus australis*. The flying adults swarmed into the orchard, where mandarin and grapefruit trees (*Citrus paradisi*) were planted. They attacked the unripe young mandarins, causing almost complete fruit fall, but left the grapefruit untouched. Similar damage to citrus in Queensland by *Leptoglossus bidentatus* is recorded in "The Queensland Agricultural and Pastoral Handbook". (Brisbane, 1951, p. 101.) Damage to the foliage of kamerere (*Eucalyptus deglupta*) in a young plantation of the Department of Forests at the Brown River was observed by E. C. Gray and the senior author. (Szent-Ivany & Womersley, 1958.) This was a combined attack by three different sucking insects—*Leptoglossus australis* (F.), the shield bug *Austromalaya* sp. (Family Pentatomidae) and the leafhopper *Paratella erudita* Mel. (Family Flatiidae.) The symptoms of the damage were rather spectacular. Before the wilting leaves had dropped to the ground, they showed bright yellow, reddish brown and dark brown colours, giving the plantation the appearance of a temperate climate forest in late autumn.

Although *Leptoglossus australis* was observed feeding on 19 other cultivated plants in the Territory of Papua and New Guinea, the damage caused to these plants has never reached the level of economic injury. They seem to be only "occasional feeders" on these plants.

Of the plants of no economic importance, the wild passionfruit (*Passiflora foetida*) is a much-favoured host plant of *Leptoglossus australis*. In the Morobe District, however, the apparently introduced cucurbit *Momordica Charantia* (used sometimes as a cover crop in plantations) seems to be the preferred host. According to the ob-

servations of the junior author, feeding occurs on all parts of this plant but the sweet mucilage around the seeds is most preferred, followed by the ripened fruits, green fruits, stems and leaves.

The names of all host plants observed in the Territory of Papua and New Guinea are listed below :—

Family Araceae :

Colocasia sp. (taro).

Family Convolvulaceae :

Ipomoea batatas (sweet potato ; leaves and vines).

Family Cruciferae :

Brassica oleracea (cabbage).

Family Cucurbitaceae ;

Cucumis melo (rockmelon).

Cucumis sativus (cucumber).

Cucurbita pepo (pumpkin).

Momordica Charantia.

Family Dioscoreaceae :

Dioscorea sp. (yam).

Family Euphorbiaceae :

Hevea brasiliensis (rubber ; seedlings).

Manihot utilissima (cassava).

Family Gramineae :

Sorghum vulgare (millet ; stem and panicles).

Oryza sativa (rice ; stalk).

Family Labiatae :

species indet.

Family Leguminosae :

Cajanus cajan (pigeon pea).

Centrosema pubescens.

Crotalaria anagyroides.

Erythrina indica (dadap ; planted as shade tree in a cacao plantation).

Family Malvaceae :

Hibiscus savdariffa (rosella).

Family Mirtaceae :

Eucalyptus deglupta (kamerere).

Family Passifloraceae :

Passiflora edulis (passionfruit).

Passiflora foetida (wild passionfruit).

Passiflora quadrangularis (grenadilla).

Family Rubiaceae :

Coffea arabica (leaves of young trees, young shoots).

Gardenia sp.

Family Rutaceae :

Citrus reticulata (mandarin : fruit).

Citrus sp. (Papuan lemon : fruit, leaves).

Family Sterculiaceae :

Theobroma cacao. (cacao ; *Leptoglossus australis* was observed on various occasions feeding on young shoots, on the stems of seedlings, on leaves, etc., but it has never been found feeding on cacao pods, as some other coreids do) (Brown, 1958, 1958a.)

In other parts of the South Pacific area, *Leptoglossus australis* was also found feeding on beans (*Phaseolus* sp.) (Dumbleton, 1954), on tomato (*Lycopersicum esculentum*) (Lever, 1948, Dumbleton, 1954) and on egg plant (*Solanum melongena*). (Lever, 1946, Pember-ton, 1954, Dumbleton, 1954.) Oakley (1953) found *Leptoglossus australis* to be very abundant on *Passiflora foetida* on various Micronesian Islands (Palau, Truk, Ulithi, Guam, Saipan, Tinian) but it seldom attacked cultivated plants such as cucumber, melon, pumpkin and squash.

NATURAL ENEMIES.

Very little is known of natural enemies of *Leptoglossus australis* in the Territory of Papua and New Guinea. The senior author observed the reduviids *Graptoclopius pallescens* and *Helonotus* sp. preying upon nymphs in the forest plantation near the Brown River. (Szent-Ivany and Womersley, 1958.)

CHEMICAL CONTROL

Leptoglossus australis (F.) is highly susceptible to D.D.T. in the form of a 0.2 per cent. spray. It is inadvisable, however, to use D.D.T. or other chlorinated hydrocarbon insecticides on cucurbits due to possible phytotoxicity. On these plants two 0.2 per cent. malathion sprays should be applied, the second 12 days after the first to kill any immature forms which may have hatched in the intervening period.

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